PREVIOUSLY….

Summary Key concepts – Introduction

Different areas of the retina capture information from specific parts of our surroundings.

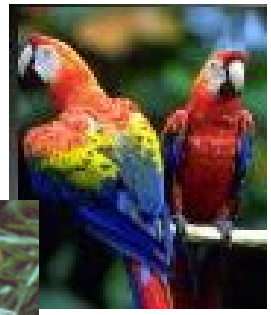
The ratio of retinal ganglion cells to photoreceptors determines sensitivity vs acuity

Variation in the number of retinal ganglion cells across the retina means that different parts of our surroundings can be processed differently!

NEXT video: how is this applied in the animal kingdom?

Retinal specialisations

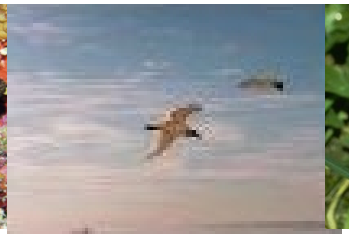
1. visual priorities and tasks:
    - prey/predator detection
    - feeding strategies
    - locomotion

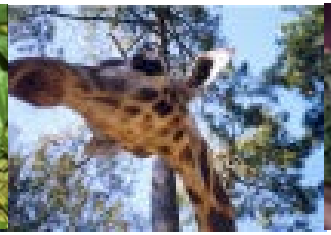


Retinal specialisations

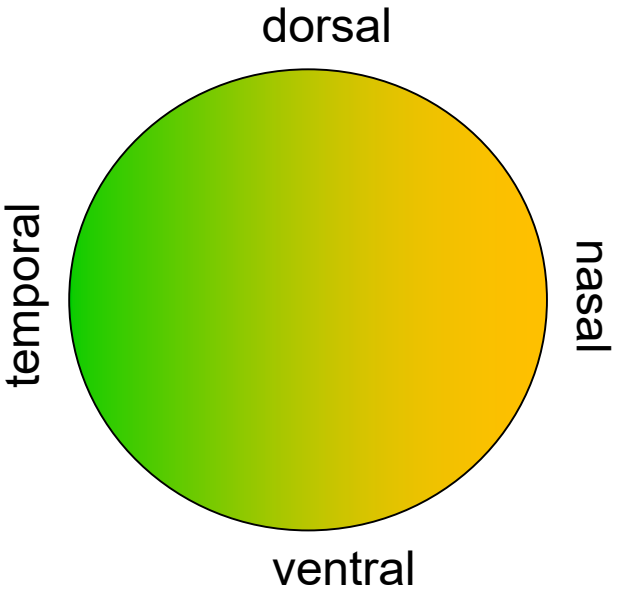
2. light environment:
   - activity pattern: diurnal, nocturnal, crepuscular, arhythmic


   - habitat: aquatic, terrestrial, sky, open land, dense forest, underground etc…

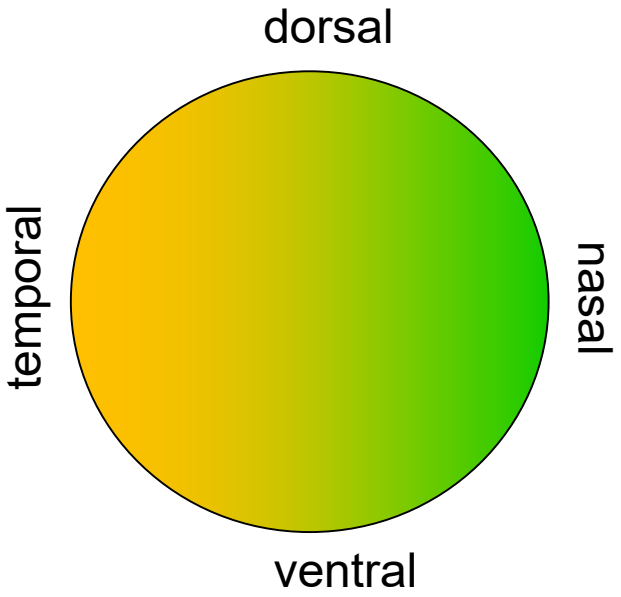



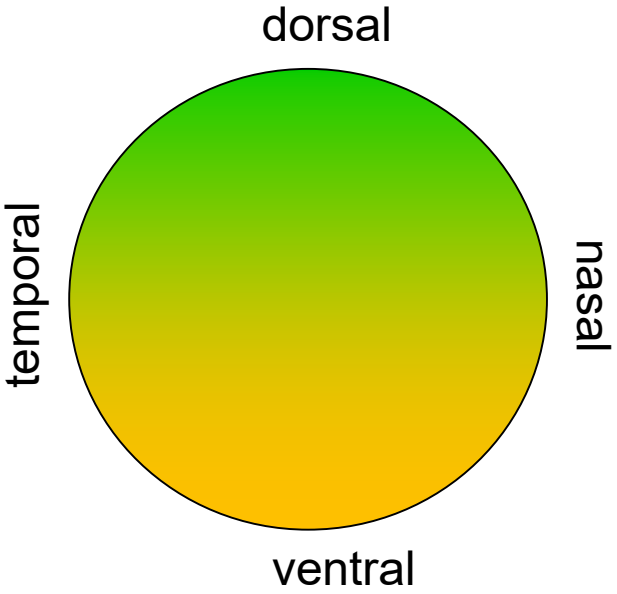



Schematic retina: right eye



ACUITY - SENSITIVITY

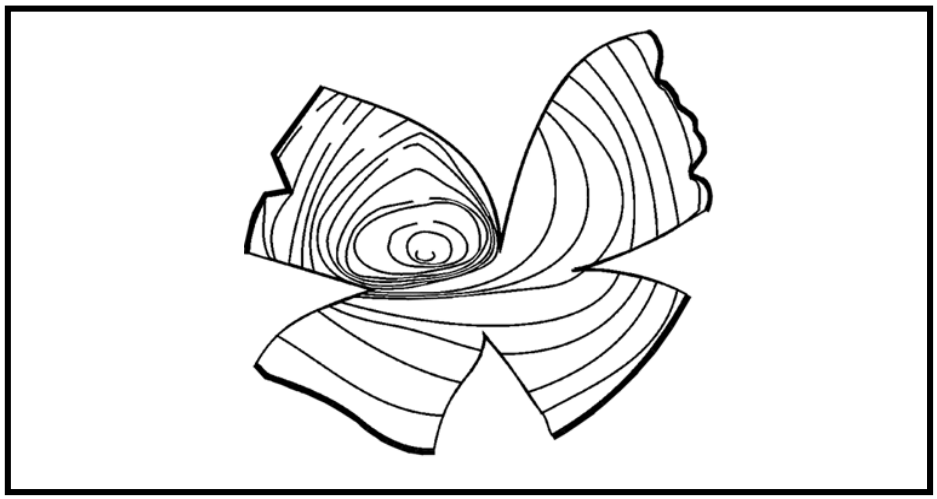


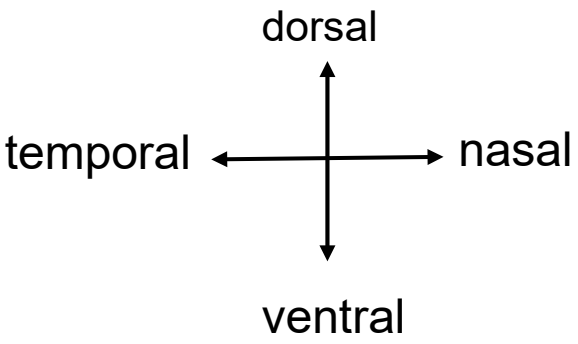


- dorsal looks ventral
- ventral looks dorsal
- nasal looks out
- temporal looks centre

Ganglion cell topography: two main types of specialisations

1)





- area centralis (AC) = high density of cells in concentric distribution
- frontal vision: acuity + depth perception + distance

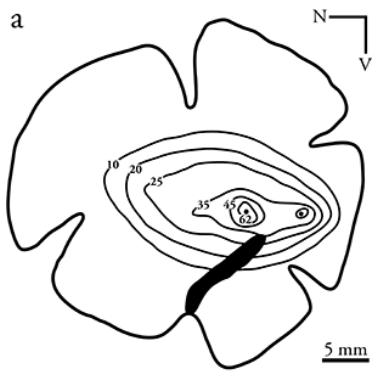
1) **Area centralis**

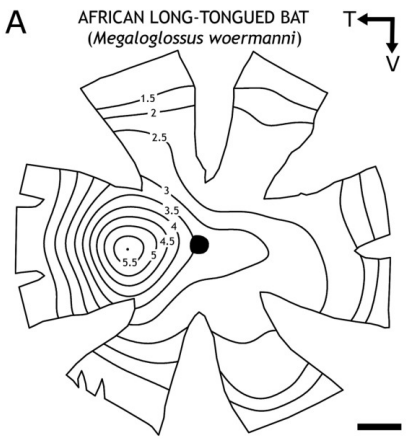
- predator: for catching prey

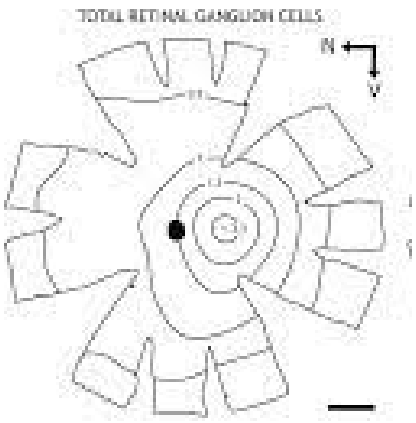
- animals living in forests/caves…

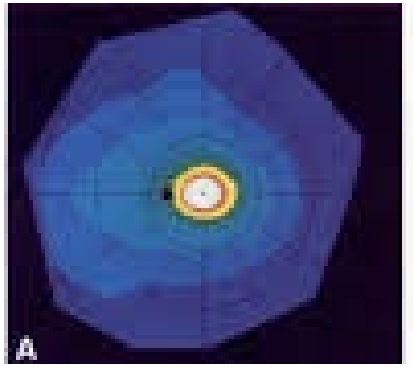
- arboreal species

- animals that use their hands



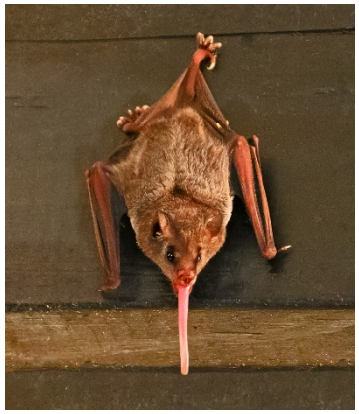






Black-chested buzzard-eagle (*Geranoaetus melanoleucus*)

https://doi.org/10.1093/acrefore/9780190264086.013.232



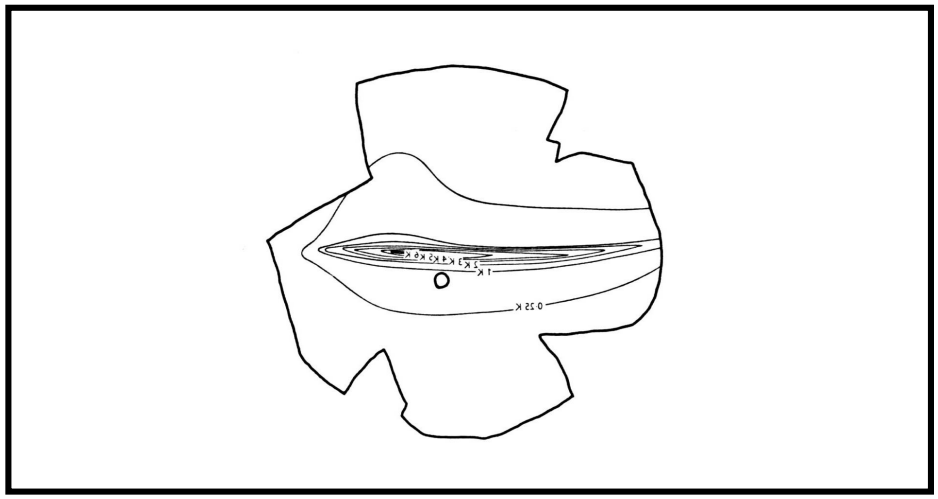
megachiropterans
https://doi.org/10.1002/cne.24055

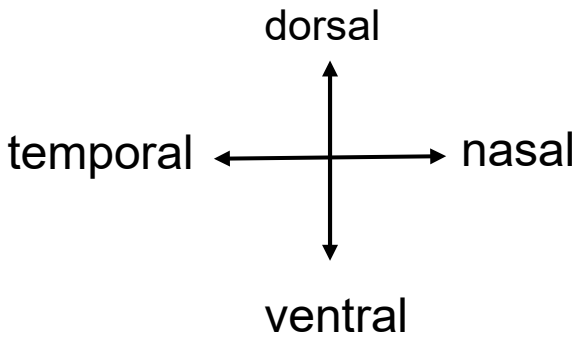
Arboreal Primate (Perodicticus potto)
DOI:10.1159/000443015

Human retina
doi:10.1002/cne.903000103

Ganglion cell topography:
two main types of specialisations

2)





- visual streak (VS) = a long band horizontal or vertical
- good panoramic vision

2) visual streak (horizontal or vertical) :

- prey: scan horizon for predators

- animals living in open habitats

- plant/static food-eating animals

Can you find human/popular culture/superhero references?

Can you find some real animal examples?

Terrain Theory: Hughes

Specialisations related to habitat:

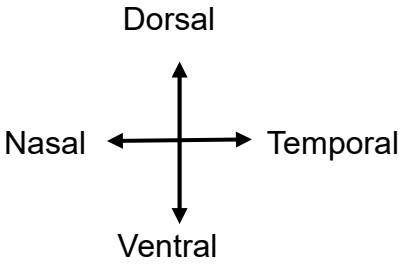
- area centralis: dense vegetation
- visual streak: open habitat

..more to it…

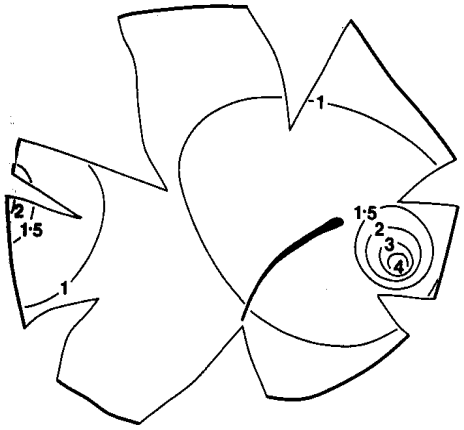
- What if an animal has both?

- What if an animal has none?

Retinal topography: fish



concentric

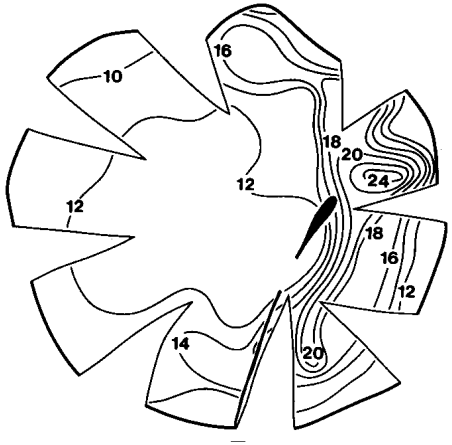


a) open ocean ?

b) coral cave ?

c) deep sea ?

vertical VS + temporal AC

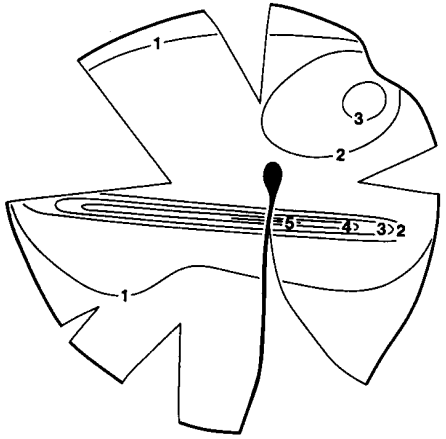


a) open coral ?

b) deep sea ?

c) mid-water ?

horizontal VS

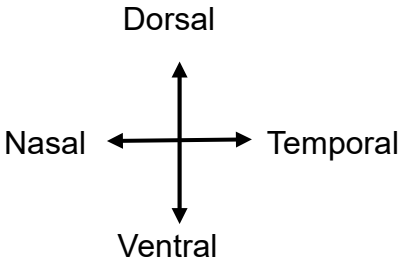


a) coral cave ?

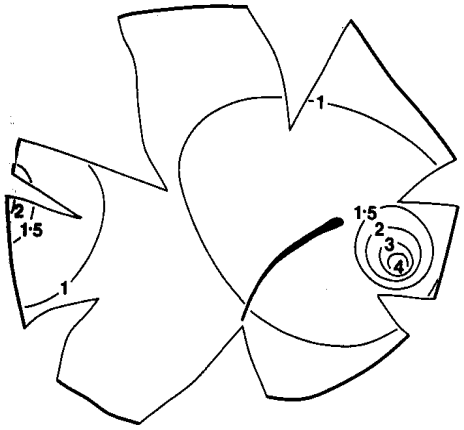
b) deep sea ?

c) open coral ?

Retinal topography: fish

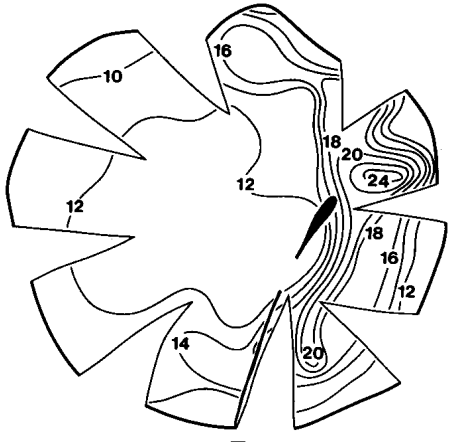


concentric



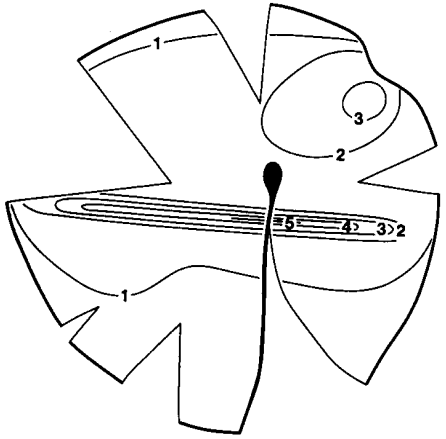
b) coral cave

vertical VS + temporal AC



b) deep sea

horizontal VS

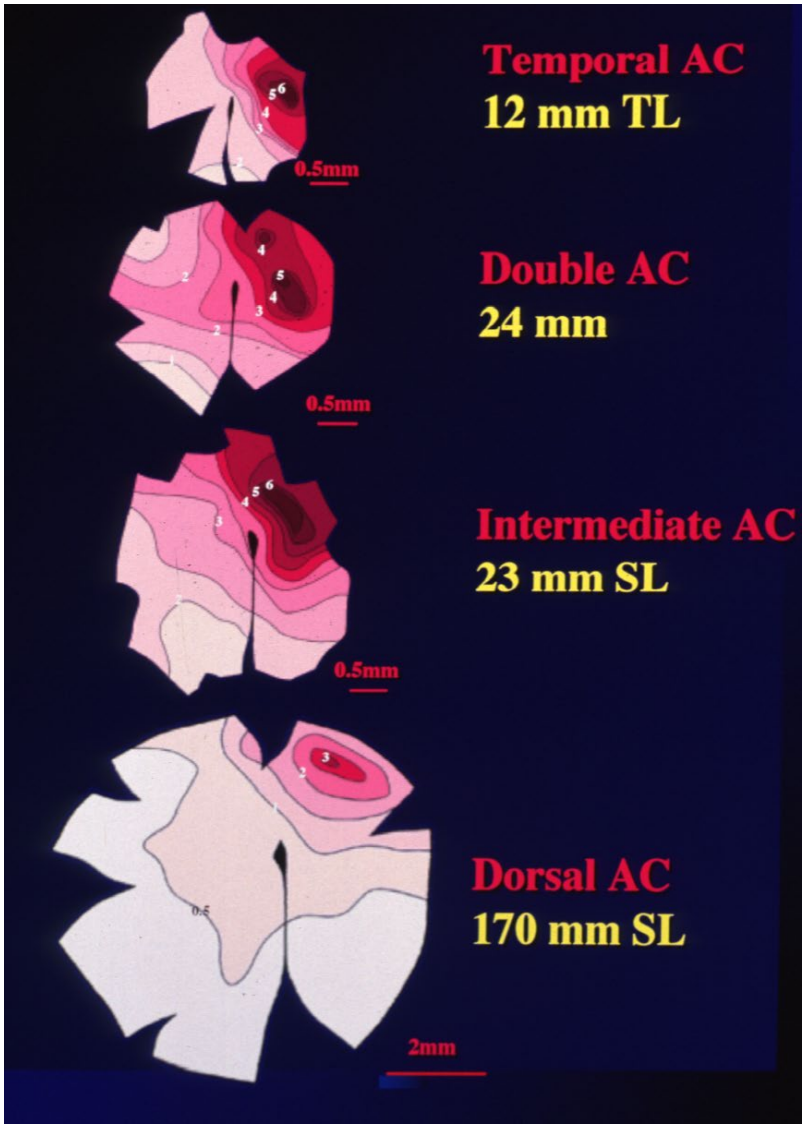


c) open coral

Location of AC in black bream changes as feeding behaviour changes

juvenile

adult



mid-water planktivores

surface and benthic

exploratory surface and benthic

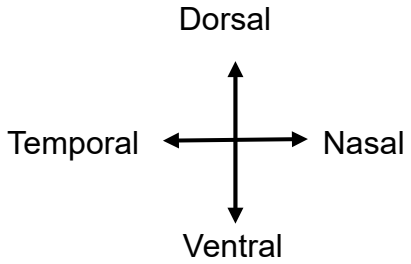
bentho-pelagic

Retinal ganglion cell distribution: reptiles & birds

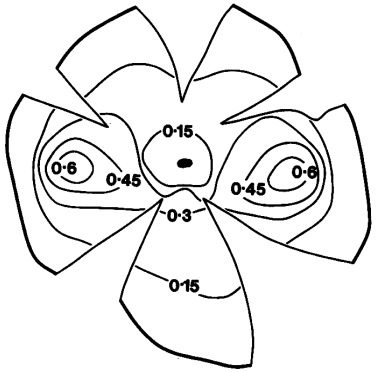
http://www.retinalmaps.com.au/

Species	Class	Habitat	Retinal specialisation
Pseudemys scripta	Reptilia	Near water edge	Horizontal VS
Ctenophorus nuchalis	Reptilia	Open arid areas	Horizontal VS
Carogyps atratus	Aves	Perched lie-in-wait predator	AC, temporal
Gallus domesticus	Aves	Terrestrial ground feeder	AC, central

Retinal topography: extremes!



Bottlenosed dolphin

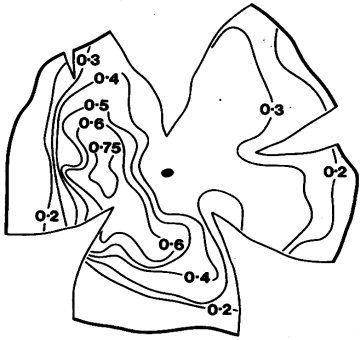


Two Area Centralis, 2 theories:

1) temporal AC = aerial vision
   nasal AC = aquatic vision

2) temporal AC = frontal vision in rapid swimming
   nasal AC = increase visual field due to restricted eye and head mobility

Two-toed sloth



Temporal AC + vertical VS from temporal to ventral retina:

•Temporal AC = accurate position of claws around branch

•Vertical VS = for vision while hanging upside down, vertical tree trunks?

Marsupials?

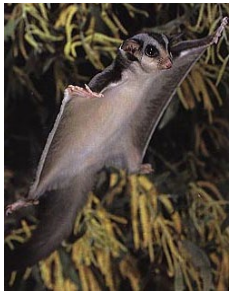
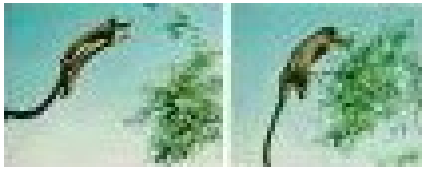
- terrestrial



- arboreal





- fossorial…


- many in between: semi-arboreal, semi-fossorial etc…

diets

herbivore

carnivore

omnivore

folivore

nectarivore

myrmecophage

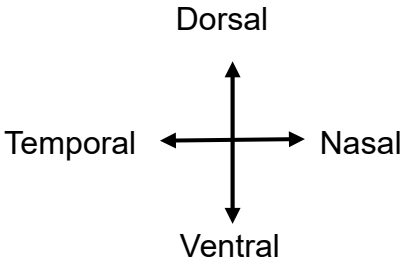
fungivore

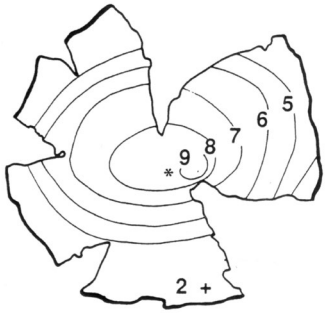
activity patterns

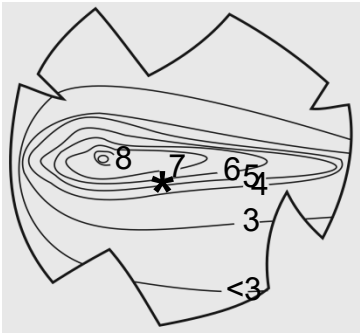
diurnal, nocturnal, crepuscular, arhythmic

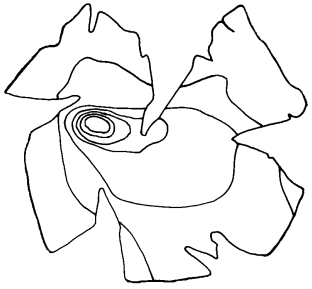
prey and/or predator

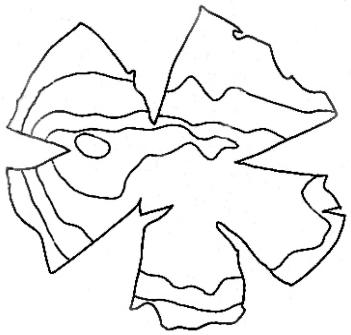
Retinal topography: marsupials

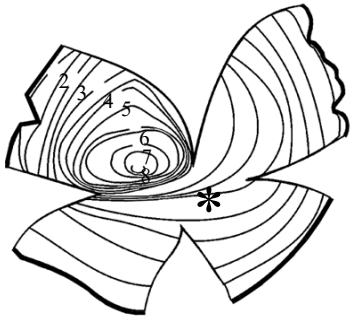










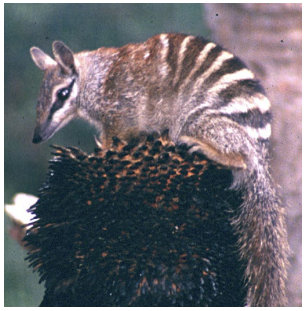


honey possum

fat-tailed dunnart

quokka

quenda



numbat

Summary key concepts Part 1 Retinal ganglion cell specialisations

Retinal ganglion cell distributions reflect visual priorities (tasks), light environment and phylogeny

NEXT video: What about the photoreceptors?